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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
AHN, SAM K	

ART UNIT	PAPER NUMBER
2637	

DATE MAILED: 09/06/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/885,890	MATSUGATANI ET AL.	
	Examiner	Art Unit	
	Sam K. Ahn	2637	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *amendment, 03/15/05*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-8 and 10-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *8* is/are allowed.

6)☒ Claim(s) *1,3-7 and 10-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *19 June 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Allowable Subject Matter

1. The indicated allowability of claims11,12,15,17 and 18 are withdrawn in view of the newly discovered reference(s) to Fujimoto. Rejections based on the newly cited reference(s) follow.

Claim Objections

2. Claim 3 is objected to because of the following informalities:

In claim 3, line 10, delete "carrier hold" and insert "carrier hole".

Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 11 and 12 are rejected under 35 U.S.C. 102(e) as being anticipated by Fujimoto et al. USP 6,115,426 (Fujimoto).

Regarding claim 11, Fujimoto teaches a communication device using a communication method of simultaneously transmitting and receiving a plurality of

N carriers to receive known signals by K (≤N) carriers among the N carriers, the device comprising:

a transmitter unit for transmitting transmission signals having a guard interval added thereto (see Tg in Fig.5);

means for determining (4 in Fig.1) from the received known signals an amount of shift of amplitude and phase of each of the K carriers (note col.8, lines 59-61) indicative of the known signal (reference signal, note col.8, lines 62-67) to determine delay information of receiving radio waves in response to thus determined amount of shift (note col.8, lines 48-55); and a time setting unit for setting a time of the guard interval in response to the delay information (note col.13, lines 12-17 and 40-47).

Regarding claim 12, Fujimoto further teaches the transmitter unit transmits information signals together with the guard interval as the transmission signals, the guard interval being added to a leading side of the information signal (see Fig.5 where Tg, guard time, is in the leading side of Td, data); and the time setting unit sets, when the delay information calculating unit determines delay in a plurality of receiving radio waves as the delay information, the time of the guard interval to a value longer than a maximum delay of delays in the plurality of receiving radio waves (note col.13, lines 12-17 and 40-47).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1,3 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fujimoto et al. USP 6,115,426 (Fujimoto) in view of Hiramatsu et al. USP 6,708,020 B1 (Hiramatsu).

   In claims 1 and 3, Fujimoto teaches a communication device using a communication method of simultaneously transmitting and receiving a plurality of N carriers to receive known signals by K ($\leq$N) carriers among the N carriers, the device comprising: means for determining (4 in Fig.1) from the received known signals an amount of shift of amplitude and phase of each of the K carriers (note col.8, lines 59-61) indicative of the known signal (reference signal, note col.8, lines 62-67) to determine delay information of receiving radio waves in response to thus determined amount of shift (note col.8, lines 48-55); and means for determining the delay information (weighting coefficient) based on the amount of shift in each of the K carriers (g1 ~ gk).

   However, Fujimoto does not explicitly teach means for estimating, when there is a carrier hole, an amount of shift of the amplitude and phase in a part corresponding to the carrier hole based on the amount of shift of carriers next to the carrier hole among the N carriers.

Hiramatsu teaches means for estimating (1118 in Fig.11), when there is a carrier hole (unmeasured reception electric field), an amount of shift of the amplitude and phase in a part corresponding to the carrier hole based on the amount of shift of carriers next to the carrier hole among the N carriers (note col.13, line 52 – col.14, line 11). Hiramatsu also teaches (see Fig.4) means for calculating, when there is a carrier hole, (P1) an amount of shift of the carrier in a lower (P0) and higher (P2) frequency side next to the carrier hole among the N carriers (note col.13, lines 55-64). Therefore, it would have been obvious to one skilled in the art at the time of the invention to incorporate the teaching of Hiramatsu in the system of Fujimoto by estimating any unmeasured reception electric field or carrier hole by implementing linear interpolation for the purpose of producing a delay information (phase and amplitude characteristics) of unmeasured sampling points, thus reduce the number of sampling points, as taught by Hiramatsu (note col.13, lines 41-46). Thus, by producing delay information for the carrier hole, one skilled in the art may be motivated to provide the delay information of the carrier hole to the means for determining for the purpose of considering the amount of shift of the carrier hole to produce a more accurate delay information.

Regarding claim 10, Fujimoto in view of Hiramatus teach all subject matter claimed, as applied to claim 1. Fujimoto further teaches a transmitter unit for transmitting transmission signals having a guard interval added thereto (see Tg in Fig.5); and a time setting unit for setting a time of the guard interval to a

maximum configurable time(note col.13, lines 12-17 and 40-47, wherein the maximum configurable time may be set depending on the delay time).

5. Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fujimoto et al. USP 6,115,426 (Fujimoto) in view of Hiramatsu et al. USP 6,708,020 B1 (Hiramatsu) and Kuwahara et al. USP 6,084,928 (Kuwahara).

   Regarding claims 4 and 5, Fujimoto in view of Hiramatsu teach all subject matter claimed, as applied to claim 1. Although Fujimoto teaches the determining means, as explained above, Fujimoto in view of Hiramatsu do not teach the determining means uses MUSIC and ESPRIT method.

   Kuwahara teaches means for determining (19 in Fig.1) using MUSIC (note col.7, line 4) and ESPRIT (note col.4, line 31) method. Therefore, it would have been obvious to one skilled in the art at the time of the invention to incorporate the teaching of Kuwahara in the system of Fujimoto by implementing the MUSIC and ESPRIT method in the means for determining for the purpose of improving the calculation the delay information also based on the arrival angle (note col.3, lines 61-67 of Kuwahara).

6. Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fujimoto et al. USP 6,115,426 (Fujimoto) in view of Anderson et al. USP 6,229,792 B1 (Anderson).

Regarding claim 6, Fujimoto teaches means for determining (4 in Fig.1) from the received known signals an amount of shift of amplitude and phase of each of the K carriers (note col.8, lines 59-61) indicative of the known signal (reference signal, note col.8, lines 62-67) to determine delay information of receiving radio waves in response to thus determined amount of shift (note col.8, lines 48-55). However, Fujimoto does not teach a detector for detecting a leading head of rthe receiving radio waves; and a timing determining unit for determining timing that the detector first detects the leading head of the receiving radio waves as synchronization timing of the receiving radio waves.

Anderson teaches a detector for detecting a leading head (215 in Fig.2) of the receiving radio waves; and a timing determining unit for determining timing that the detector first detects the leading head of the receiving radio waves as synchronization timing (synchronization preamble) of the receiving radio waves (note col.20, lines 46-56). Therefore, it would have been obvious to one skilled in the art at the time of the invention to incorporate the teaching of Anderson in the system of Fujimoto by placing transmitting the synchronization preamble in the incoming wave of Fujimoto (see Fig.6) for the purpose of expedite synchronization and including a power control command, as taught by Anderson (note col.20, lines 44-56).

Regarding claim 7, Fujimoto in view of Anderson teach all subject matter claimed, as applied to claim 6. Anderson further teaches the detector outputs a

correlative value of the leading head of the receiving radio waves (note col.20, line 51); and although Anderson does not explicitly teach the timing determining unit compares the correlative value with a threshold value to determine the synchronization timing based on this comparison, it would have been obvious to one skilled in the art at the time of the invention to implement as such, since the output of the digital correlator of Anderson may be compared to a threshold in order to determine whether the correlative value meets an acceptable level, otherwise, even a minimal correlative value may be selected for synchronization, and resulting in a poor reception of signals. Thus, by setting the threshold to an acceptable level, the receiver may synchronize to a timing when the correlative value exceeds a threshold with acceptable level.

7. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fujimoto et al. USP 6,115,426 (Fujimoto) in view of Sato USP 6,058,149.

Regarding claim 13, Fujimoto teaches a communication device using a communication method of simultaneously transmitting and receiving a plurality of N carriers to receive known signals by K ($\leq$N) carriers among the N carriers, the device comprising:

a transmitter unit for transmitting transmission signals having a guard interval added thereto (see Tg in Fig.5);

means for determining (4 in Fig.1) from the received known signals an amount of shift of amplitude and phase of each of the K carriers (note col.8, lines 59-61)

indicative of the known signal (reference signal, note col.8, lines 62-67) to determine delay information of receiving radio waves in response to thus determined amount of shift (note col.8, lines 48-55); and a time setting unit for setting a time of the guard interval to a maximum configurable time(note col.13, lines 12-17 and 40-47, wherein the maximum configurable time may be set depending on the delay time).

However, Fujimoto does not explicitly teach a time information adding unit for adding time information indicative of the guard interval to the transmission signal. Sato teaches a time information adding unit for adding time information indicative of the guard interval (note col.20, lines 40-46) to the transmission signal. Therefore, it would have been obvious to one skilled in the art at the time of the invention to incorporate the teaching of Sato in the system of Fujimoto by transmitting time information indicative of the guard interval for the purpose of adjusting the guard time, thus maximizes efficiency of data transfer as guard time may be configured (note col.20, lines 40-46 of Sato) depending on the delay time of arrival of transmissions (note col.13, lines 41-47 of Fujimoto).

8. Claims 14-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fujimoto et al. USP 6,115,426 (Fujimoto) in view of Forssen et al. USP 5,615,409 (Forssen).

Regarding claims 14 and 17, Fujimoto teaches a communication device using a communication method of simultaneously transmitting and receiving a plurality of N carriers to receive known signals by K (≤N) carriers among the N carriers, the device comprising: M sets of antennas and receivers (A1~Ak); a delay information calculating unit for determining (4 in Fig.1) from the received known signals an amount of shift of amplitude and phase of each of the K carriers (note col.8, lines 59-61) indicative of the known signal (reference signal, note col.8, lines 62-67) to determine delay information of receiving radio waves in response to thus determined amount of shift (note col.8, lines 48-55); wherein the delay information calculation unit determines, upon determination of the delay information of a plurality of receiving radio waves to selectively demodulate the receiving radio wave (note col.8,lines 35-37). However, Fujimoto does not explicitly teach wherein the delay information calculating unit determine an arrival direction, and does not explicitly teach selectively demodulate the receiving radio wave of the arrival direction having maximum receiving power.

Forssen teaches the delay information calculating unit determine an arrival direction (note col.4, lines 38-40) and further teaches selectively demodulate(22 in Fig.1) the receiving radio wave of the arrival direction having maximum receiving power (506 in Fig.5 and note col.4, lines 51-55). Therefore, it would have been obvious to one skilled in the art at the time of the invention to incorporate the teaching of Forssen in the system of Fujimoto by implementing well-known algorithms such as MUSIC and ESPRIT (note col.4, line 40) for the

purpose of identifying the location of mobile stations, and thus reduce co-channel interference (note col.1, lines 39-41 and 57-62).

And further, it would have been obvious to one skilled in the art at the time of the invention to incorporate the teaching of Forssen in the system of Fujimoto by selecting from different receive antennas (A1~Ak in Fig.1) having the maximum receiving power and demodulate (5) for the purpose of removing any unusable signals (note col.4, lines 55-59 of Forssen), thus effectively demodulate by reducing the number of signals to be further processed.

Regarding claim 15, Fujimoto teaches a communication device using a communication method of simultaneously transmitting and receiving a plurality of N carriers to receive known signals by K ($\leq$N) carriers among the N carriers, the device comprising: M sets of antennas and receivers (A1~Ak); a separator unit for separating signals received by the M sets of antennas and receivers into signals; a delay information calculating unit for determining (4 in Fig.1) from the received known signals an amount of shift of amplitude and phase of each of the K carriers (note col.8, lines 59-61) indicative of the known signal (reference signal, note col.8, lines 62-67) to determine delay information of receiving radio waves in response to thus determined amount of shift (note col.8, lines 48-55). However, Fujimoto does not explicitly teach wherein the delay information calculating unit determine an arrival direction, and does not explicitly teach the separator unit separating signals for each arrival direction.

Forssen teaches the delay information calculating unit determine an arrival direction (note col.4, lines 38-40) and further teaches a separator unit (404 in Fig.4) separating signals for each arrival direction (note col.4, lines 41-46). Therefore, it would have been obvious to one skilled in the art at the time of the invention to incorporate the teaching of Forssen in the system of Fujimoto by implementing well-known algorithms such as MUSIC and ESPRIT (note col.4, line 40) for the purpose of identifying the location of mobile stations, and thus reduce co-channel interference (note col.1, lines 39-41 and 57-62).
And further, it would have been obvious to one skilled in the art at the time of the invention to incorporate the teaching of Forssen in the system of Fujimoto by separating signals for each arrival direction for the purpose of removing any unusable signals (note col.4, lines 55-59 of Forssen), thus effectively demodulate by reducing the number of signals to be further processed.

Regarding claims 16 and 18, Fujimoto teaches a communication device using a communication method of simultaneously transmitting and receiving a plurality of N carriers to receive known signals by K ($\leq$N) carriers among the N carriers, the device comprising: M sets of antennas and receivers (A1~Ak); a demodulation unit (5); a delay information calculating unit for determining (4 in Fig.1) from the received known signals an amount of shift of amplitude and phase of each of the K carriers (note col.8, lines 59-61) indicative of the known signal (reference signal, note col.8, lines 62-67) to determine delay information of receiving radio

waves in response to thus determined amount of shift (note col.8, lines 48-55). Although Fujimoto does not explicitly teach wherein the demodulator unit, upon determination of the delay information of a plurality of receiving radio waves, receiving radio waves among the plurality of receiving radio waves having delay longer than the time of guard interval prior to demodulation based on the delay information thus determined, Fujimoto teaches that during period Td of data are sampled and demodulated while during guard interval period Tg are ignored (note col.13, lines 9-11), and further teaches an example where the delay is longer than the time of guard interval resulting in distortion (note col.13, lines 12-23). Therefore, it would have been obvious to one skilled in the art at the time of the invention to eliminate any received signals having the delay longer than the time of guard interval for the purpose of reducing the amount of demodulation, as the signal would have distortion.

However, Fujimoto does not explicitly teach wherein the delay information calculating unit determine an arrival direction.

Forssen teaches the delay information calculating unit determine an arrival direction (note col.4, lines 38-40) and further teaches a separator unit (404 in Fig.4) separating signals for each arrival direction (note col.4, lines 41-46). Therefore, it would have been obvious to one skilled in the art at the time of the invention to incorporate the teaching of Forssen in the system of Fujimoto by implementing well-known algorithms such as MUSIC and ESPRIT (note col.4,

line 40) for the purpose of identifying the location of mobile stations, and thus reduce co-channel interference (note col.1, lines 39-41 and 57-62).

9. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fujimoto et al. USP 6,115,426 (Fujimoto) in view of Alamouti et al. USP 5,933,421 (Alamouti).

Regarding claim 19, Fujimoto teaches all subject matter claimed, as applied to claim 11. However, Fujimoto does not explicitly teach the communication method is an orthogonal multiplexing carrier method.

Alamouti teaches the communication method is an orthogonal multiplexing carrier method (OFDM, note col.5, lines 21-29). Therefore, it would have been obvious to one skilled in the art at the time of the invention to incorporate the teaching of Alamouti in the system of Fujimoto by implementing the modulation method using OFDM for the purpose of reducing inter-symbol interference, wherein OFDM is well-known in the art as having low inter-symbol interference.

Allowable Subject Matter

10. Claim 8 is allowed.

11. The following is a statement of reasons for the indication of allowable subject matter:

Present application discloses a communication device implementing antenna array transmitting and receiving with guard interval. Prior art teaches or suggests all subject matter claimed. However, prior art does not teach the combination of determining means, detector, timing determining unit, along with a discriminator unit

for determining whether the received signal was received prior to the synchronization timing in response to the delay information, a timing reconfiguration unit for reconfiguring the synchronization timing prior to the synchronization timing and a delay information recalculating unit for determining the delay information again in response to the reconfigured synchronization timing and the received signals.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sam Ahn whose telephone number is (571) 272-3044. The examiner can normally be reached on Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jay Patel can be reached on (571) 272-2988. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Sam K. Ahn
8/24/05